gfun[listtodiffeq] - find a linear differential equation for the generating function

gfun[seriestodiffeq] - find a linear differential equation satisfied by a series

Calling Sequence

listtodiffeq(**l**, **y(x)**, <**[typelist]**>)

seriestodiffeq(**s**, **y(x)**, <**[typelist]**>)

Parameters

`l` - a list

`s` - a series

`y,z` - the name of the unknown function and the generic variable

`[typelist]` - (optional) a list of generating function types

Description

- The procedures **listtodiffeq** and **seriestodiffeq** compute a linear differential equation in **y(x)** with polynomial coefficients in **x** satisfied by the generating function **y(x)** of the expressions in **l** or **s**, this generating function being of one of the types specified by typelis for example, ordinary (ogf) or exponential (egf). For a full list of available choices see gftypes).
- If **typelist** contains more than one element, these types are tried in order.
- If **typelist** is not provided, the default **optionsgf=['ogf','egf']** is used. The output is a list whose second element is the type for which an equation was found, and whose first element is the differential equation satisfied by the generating function.
- In the current implementation, the maximal order is 2 and the maximum degree of the coefficients is 3. This can be changed by modifying the variables gfun['maxordereqn'] and gfun['maxdegcoeff'].
- If sufficiently many terms were given, and no solution was found, it means that the generating function does not satisfy any linear differential equation of order less or equal to gfun ['maxordereqn'] with coefficients of degree less or equal to gfun['maxdegcoeff'].

Examples

```
> with(gfun):
  l:=[1,2,6,22,91,408,1938,9614,49335,260130,1402440,7702632,
  42975796,243035536,1390594458,8038677054,46892282815,
  275750636070,1633292229030,9737153323590]:
  listtodiffeq(l,y(x));
```

$$\left[\left\{12+(-12+60x)\,y(x)+(-18x+108x^2)\left(\frac{d}{dx}y(x)\right)+(27x^3-4x^2)\left(\frac{d^2}{dx^2}y(x)\right),\ y(0)=1,\ D(y)(0)=2\right\},\ ogf\right] \qquad \textbf{(2.1)}$$

```
> s:=series(exp(x)/sqrt(1-x),x,7);
```

$$s := 1 + \frac{3}{2}x + \frac{11}{8}x^2 + \frac{53}{48}x^3 + \frac{115}{128}x^4 + \frac{2947}{3840}x^5 + \frac{31411}{46080}x^6 + O(x^7) \tag{2.2}$$

```
> seriestodiffeq(s,y(x));
```

$$\left[\left\{y(0) = 1, (-3 + 2x)\,y(x) + (2 - 2x)\left(\frac{d}{dx}y(x)\right)\right\}, ogf\right] \tag{2.3}$$

See Also

gfun, gfun[parameters]